

On some Larval and Juvenile Stages of three species of Fish from the River Jamuna at Allahabad¹

BY

K. L. SEHGAL

Central Inland Fisheries Research Sub-Station, Allahabad

(With four text-figures)

INTRODUCTION

In the course of investigations on the breeding habits and spawning season of the common freshwater fishes of the rivers Ganga and Jamuna at Allahabad during the first half of 1958, a large number of developing eggs, early larvae, and fry of several species were collected, many of which are already well known and have been described in the literature. The work prior to 1950 was summarised by Jones (1950) in his bibliography of the breeding habits and development of the fishes of the inland waters of India. Notable contributions have been made since then by Alikunhi (1955), Alikunhi & Chaudhuri (1954), Karamchandani & Motwani (1954, 1955, 1956) and Pakrasi & Alikunhi (1952).

The present communication deals with the larval stages of two cypriids *Barilius vagra* (Hamilton), *Oxygaster gora* (Hamilton), and a mugilid *Liza cascasia* (Hamilton).

MATERIAL AND METHOD

The material for the present study was collected from the River Jamuna near Sujawan, about 10 miles upstream of its confluence with the River Ganga, during the months of March to May 1958. Collections were mostly made from the Dan fishing vessel by towing one-metre and half-metre ring nets of organdi cloth. The larvae were then sorted in the laboratory and reared to obtain connected series to identifiable stages. Most of the camera lucida drawings were made from freshly preserved material, but in a few cases live specimens narcotised in menthol were also used. The lengths of the different stages in the text indicate total lengths.

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Barilius vagra (Hamilton)

The species is frequently encountered in the commercial catches at Allahabad during early summer months, when small-meshed drag nets are operated, but it does not constitute a fishery of more than minor importance. Numerous larvae and juveniles of the fish were collected from the River Jamuna in the month of March. According to Day (1878), this species attains about six inches (=152 mm.) in length. Specimens ranging between 130 to 150 mm. occur in commercial catches.

LARVAL STAGES

4.80 mm. stage (Fig. 1, a) : This is the earliest available stage and shows the mouth as being well developed, and slightly oblique. The eyes are large. The yolk sac is still present and so also the dorsal and anal fin folds, the latter showing a swollen contour in the position of the future anal fin. The tip of the notochord is slightly upturned. The pectoral fins are rudimentary. The larva has 19 countable myotomes present at this stage. Three large chromatophores are present along the mid ventral line in the post-anal region of the body, while a few large and small ones occur in the occipital area. A few scattered chromatophores are also present along the dorsal and postero-ventral sides of the yolk sac.

6.70 mm. stage (Fig. 1, b) : The mouth is oblique and prominent. All the fins are present, but still rudimentary, and the dorsal and anal fins show seven and ten ill-defined rays respectively. The tip of the notochord is sharply bent upwards. The myotomes of the larva have now increased to 25. The chromatophores numbering seven and six are respectively arranged in a characteristic pattern along the mid-dorsal and mid-ventral line along the base of the dorsal and anal fins. A double row of chromatophores is present on the lateral side of the body of which the upper one runs from the middle of the caudal peduncle to the posterior border of the orbit, while the lower row ends ahead of the anal fin. A few scattered chromatophores are seen in the shoulder and occipital regions.

10.00 mm. stage (Fig. 1, c) : The shape of the mouth is more or less like that of the adult. The posterior end of the maxilla reaches to the middle of the orbit. All the fins are now almost fully formed with their respective number of rays. The upper half of the body has become slightly brownish and the number of chromatophores described in the preceding stages are now less. The double row of chromatophores of the earlier stage has now merged into a single row, arranged in the form of a chain running from the base of the caudal to the pre-dorsal region, giving the appearance of a thin dark line. The small patterns of chromatophores on the occiput and pectoral regions still persist as also the post-dorsal and post-anal chromatophores.

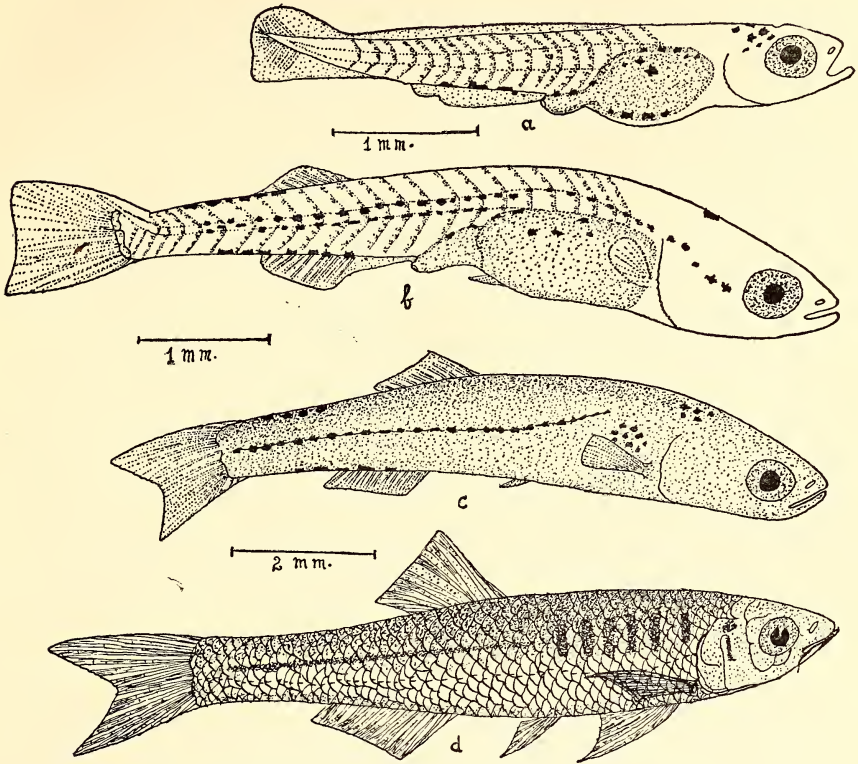


Fig. 1. Larval stages of *Barilius vagra* (Hamilton)

24.00 mm. stage (Fig. 1, d) : With growth from the post-larval stage described above, to the juvenile condition, several changes are noticed. By now all the fin rays are well formed. The maxilla is well developed and extends to below the middle of the orbit. A pair of maxillary barbels has appeared. At this stage, the upper half of the body becomes brownish, and the lower half yellowish. On the side of the body above the pectoral fin, six transverse bands are present. The thin dark lateral band of the preceding stage still persists and is seen upto the 38-40 mm. size.

The early stages of *B. vagra* indicate that the dorsal fin is situated nearer to the base of the caudal fin than to the head. But at the 24 mm. stage the dorsal fin is nearer to the head than the caudal base. With growth the anal fin also slightly moves forward lying below the dorsal fin. The following characteristic features were observed in the specimens ranging between 27 and 50 mm. in total length.

The length of the head is 5.2 to 5.4 and the maximum height of the body is 5.8 to 6.1 in the total lengths. The eyes are large, the diameter being contained 3.3 to 3.7 in the length of the head. The posterior end

of the maxilla reaches to below the middle of the orbit. The upper half of the body is brownish tinged with olive and the lower half is yellowish. As the fish grows more transverse bands appear which eventually number from 10 to 12 in the adult.

TABLE I

Barilius vagra (Hamilton)
(Measurements in millimetres)

Characters	Larval Stages			
	4.80 mm. stage	6.70 mm. stage	10.00 mm. stage	24.00 mm. stage
Standard length	3.80	5.40	8.20	18.00
Length of head	1.05	1.54	2.35	5.00
Length of snout	0.31	0.40	0.55	1.50
Diameter of eye	0.42	0.54	0.88	2.00
Maximum height of body	0.94	1.54	1.70	5.50
Length from vent to tip of caudal fin	2.45	3.20	4.50	11.00

Oxygaster gora (Hamilton)

This species is found to be quite common at Allahabad and forms a minor fishery of some importance in the months of November to April. The largest specimen recorded in the commercial catches is 274 mm. in total length. The larvae of this species were collected mostly in April and juveniles from May to July. *O. gora* is essentially Indo-Gangetic in distribution.

LARVAL STAGES

4.40 mm. stage (Fig. 2, a): This is the earliest stage collected. The body of the larva is elongated. The mouth is superior and markedly upturned. The dorsal and anal fin folds are continuous, the latter being interrupted by the formation of the anal opening, thus splitting it into pre-anal and post-anal parts. The pre-anal fold extends to the 18th somite, while the post-anal is continuous with the caudal fold. The tip of the notochord is straight. Rudiments of pectoral and pelvic fins are present. The eyes are large. The body has 25 somites.

6.30 mm. stage (Fig. 2, b): The mouth is still superior and strongly oblique. The dorsal and anal fin folds have now been transformed into fins with 9 and 8 rudimentary fin rays respectively. The pre-anal fin fold still persists. The tip of the notochord is now directed upwards. The pectoral and pelvic fins are with their respective rays. The body of the larva has 48 somites. Arranged along the mid-ventral line, there are

nine post-anal chromatophores. The two pre-anal rows of chromatophores running parallel to each other have fourteen and eleven chromatophores in the lower and upper row respectively.

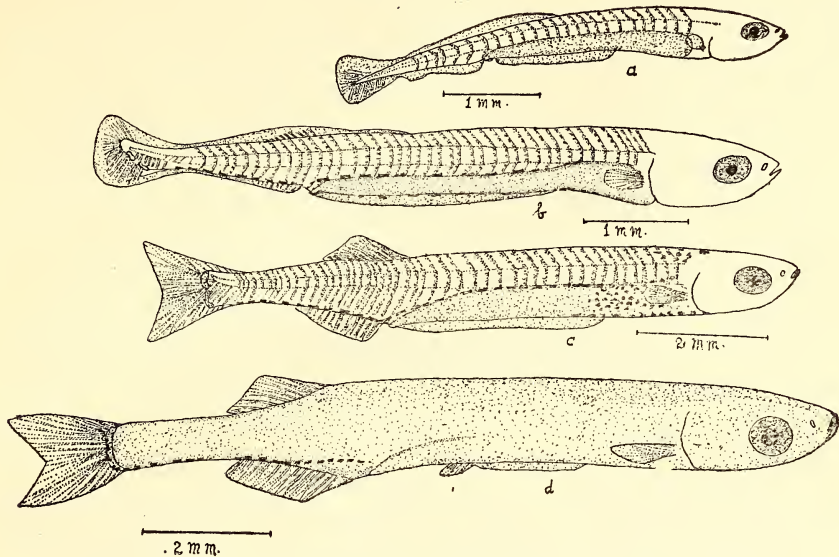


Fig. 2. Larval stages of *Oxygaster gora* (Hamilton)

9.25 mm. stage (Fig. 2, c): The mouth is still superior and oblique and the larva resembles more or less the adult in body shape. The dorsal and anal fins appear to have slightly shifted forward. Both the fins have assumed their normal shape and are characterised by 10 and 11 rays respectively. The caudal fin is of the homocercal type. The arrangement of the chromatophores is more or less the same as in the preceding stage, with the exception of some addition in number. Clusters of small chromatophores are present in the occipital region and in the area below the pectoral fin.

12.10 mm. stage (Fig. 2, d): At this stage, it is more or less a juvenile specimen, with all the characteristics of the adult. The mouth is directed obliquely upwards, lower jaw fitting into the groove of the upper jaw. The dorsal and anal fins have 10 and 16 fin rays respectively as in the adult. The vestige of the ventral fin fold still persists. Excepting the post-anal row, all the chromatophores have disappeared, and their number is now sixteen.

During the study of larval and post-larval stages of *O. gora* in their developmental history, it has been found that the position of the dorsal and anal fins has shifted backwards at every stage. The fins appear to assume their normal position by about the 29 mm. stage.

Some of the diagnostic features of *O. gora* as observed in specimens ranging from 35-80 mm. are given below.

The body of the fish is laterally compressed and the ventral surface is keeled. The mouth is directed upward. The length of the head is 5.0 to 5.4 and the maximum height of the body is 6.0 to 6.4 in the total length. The diameter of the eye is contained 3.7 to 3.9 in the head length. The sub-orbital ring of bones is broader than the diameter of the eye. The scales on the head extend to the nostrils. The colour of the body is silvery.

TABLE II
Oxygaster gora (Hamilton)
(Measurements in millimetres)

Characters	Larval Stages			
	4.40 mm. stage	6.30 mm. stage	9.25 mm. stage	12.10 mm. stage
Standard length	3.62	5.32	8.00	10.21
Length of head	0.80	1.21	1.50	2.17
Length of snout	0.20	0.30	0.54	0.73
Diameter of eye	0.27	0.30	0.56	0.67
Maximum height of body	0.57	0.75	1.12	1.34
Length from vent to tip of caudal fin	1.48	1.94	3.50	5.00

***Liza cascasia* (Hamilton)**

L. cascasia, a small mugilid fish growing to about 120 mm. in size, is very common in the rivers Ganga and Jamuna, and is always found moving in shoals along the banks. It constitutes a minor fishery at Allahabad in the months of November to March, and is caught in small-meshed drag nets in fairly large quantities. The larvae and juveniles of this species were collected in April and from June to August respectively, from the River Jamuna. According to Day (1878) *L. cascasia* occurs in the upper waters of the Ganges and Jamuna rivers, with Patna as the lower limit of distribution. It also occurs in the Brahmaputra.

LARVAL STAGES

4.70 mm. stage (Fig. 3, a) : The mouth is slightly directed upwards. The dorsal fin fold is continuous with the caudal, while the anal fold is slightly bulging in the prospective region of the anal fin. The tip of the notochord is straight. Body consists of 19 somites. There are five pre-anal and two large occipital chromatophores. Besides these, single large chromatophores are present on the posterior margin of the operculum and on the ventral side of the abdomen.

7.00 mm. stage (Fig. 3, b) : The mouth has become more prominent. The second dorsal fin has formed with six rudimentary rays. The anal

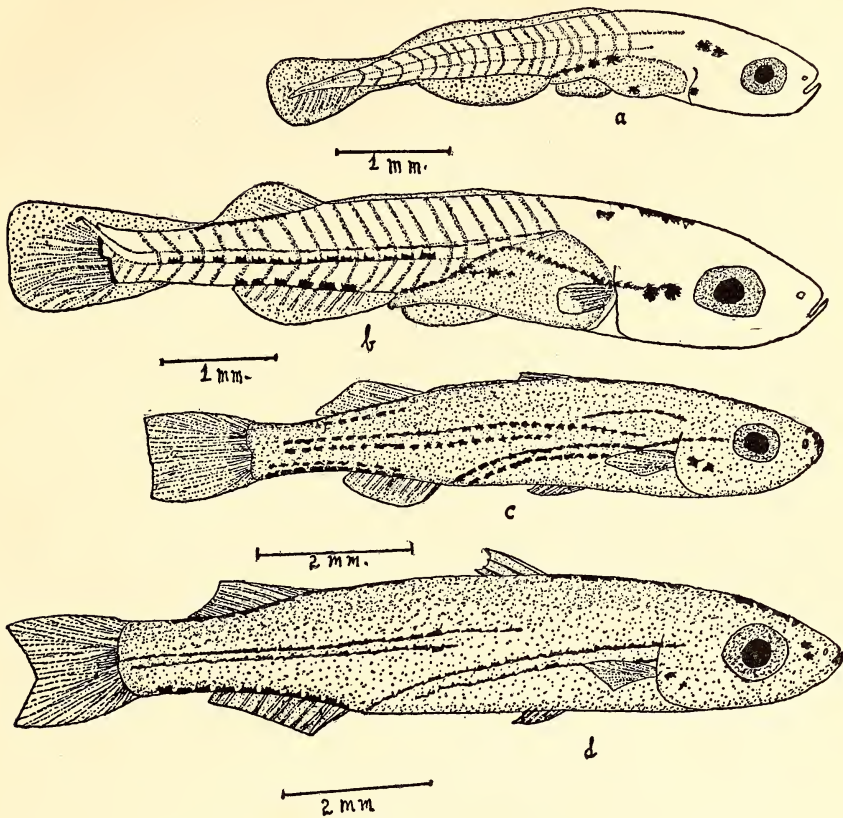


Fig. 3. Larval stages of *Liza cascasia* (Hamilton)

fin, which was a continuous fold has now 10 rays, and the pectoral fins are rudimentary. The tip of the notochord is sharply upturned. By now the larva has got 26 somites on the body. The pre-anal fold still persists. The chromatophores are now disposed in a distinct pattern. There are six large chromatophores at the base of the anal fin and a narrow band at the base of the dorsal. A chain of pre-anal chromatophores moves upward and then forward reaching the posterior margin of the eye; a few clusters are seen in the occipital region; along the lateral line on either side there is a distinct continuous row of chromatophores commencing from the base of the caudal and extending to the level of the base of first dorsal fin, and a dark band is present at the base of the caudal fin but disappears in the subsequent stages.

8.30 mm. stage (Fig. 3, c) : At this stage all the fins have been well differentiated. The first dorsal with 3 rudimentary spines has also developed. The dorsal and anal fins have now 7 and 11 rays respectively. The pectoral fins at this stage have 15 soft rays, and the pelvics have 1 spinous and 5 soft rays. The caudal is truncated. The arrangement of

the chromatophores becomes more prominent, giving an appearance of dark lines.

10.00 mm. stage (Fig. 3, d): All the fins are fully differentiated with the adult number of rays, and the fin formula at this stage is : D. 4/1/8, P15, V1/5, A 3/8, C 14. More chromatophores have been added to make the pattern, already laid, more conspicuous and this characteristic colour pattern persists till the 40.00 mm. stage.

From the development of *L. cascasia* it could be said that the relative position of the first dorsal formed at 8.30 mm. stage remains practically unchanged in the subsequent stages of development while the second dorsal fin which was relatively nearer to the first dorsal base shifts backwards. The anal also shifts backwards and comes to lie below the second dorsal. The distinctive features described below were noticed in the specimens from 25 to 40 mm. in total length.

The mouth is wide its cleft being 1/3 of the extent of its gape. It is oblique, pointing upwards. The length of the head is 4.0 to 4.5 and the maximum height of the body is 4.9 to 5.2 in the total length. The diameter of eye is contained 3.2 to 3.7 in the length of the head. The first dorsal is much nearer to the snout than to the caudal peduncle. The second dorsal arises opposite the anal. The scales are ctenoid. The coloration of body is the same as in the last (10.4 mm.) stage. But as the fish grows further it becomes brownish above the lateral line and olive below.

TABLE III

Liza cascasia (Hamilton)
(Measurements in millimetres)

Characters	Larval Stages			
	4.70 mm. stage	7.00 mm. stage	8.30 mm. stage	10.00 mm. stage
Standard length	3.77	5.58	6.45	8.76
Length of head	1.17	1.87	2.00	2.38
Length of snout	0.32	0.58	0.59	0.85
Diameter of eye	0.41	0.67	0.90	1.00
Maximum height of body	0.80	1.22	1.50	1.80
Length from vent to tip of caudal fin	2.45	3.55	3.77	4.61

Development of scales in L. cascasia (Fig. 4): In *L. cascasia* the scales first appear on the body at the 10.00 mm. stage, and are all cycloid in structure. They first appear on the head and later on the rest of the body. At 14.10 mm. stage the scales are all cycloid and longer than broad. As the post-larva grows they develop more and more and at the 16.80 mm. stage, the head has typical cycloid scales. At a later

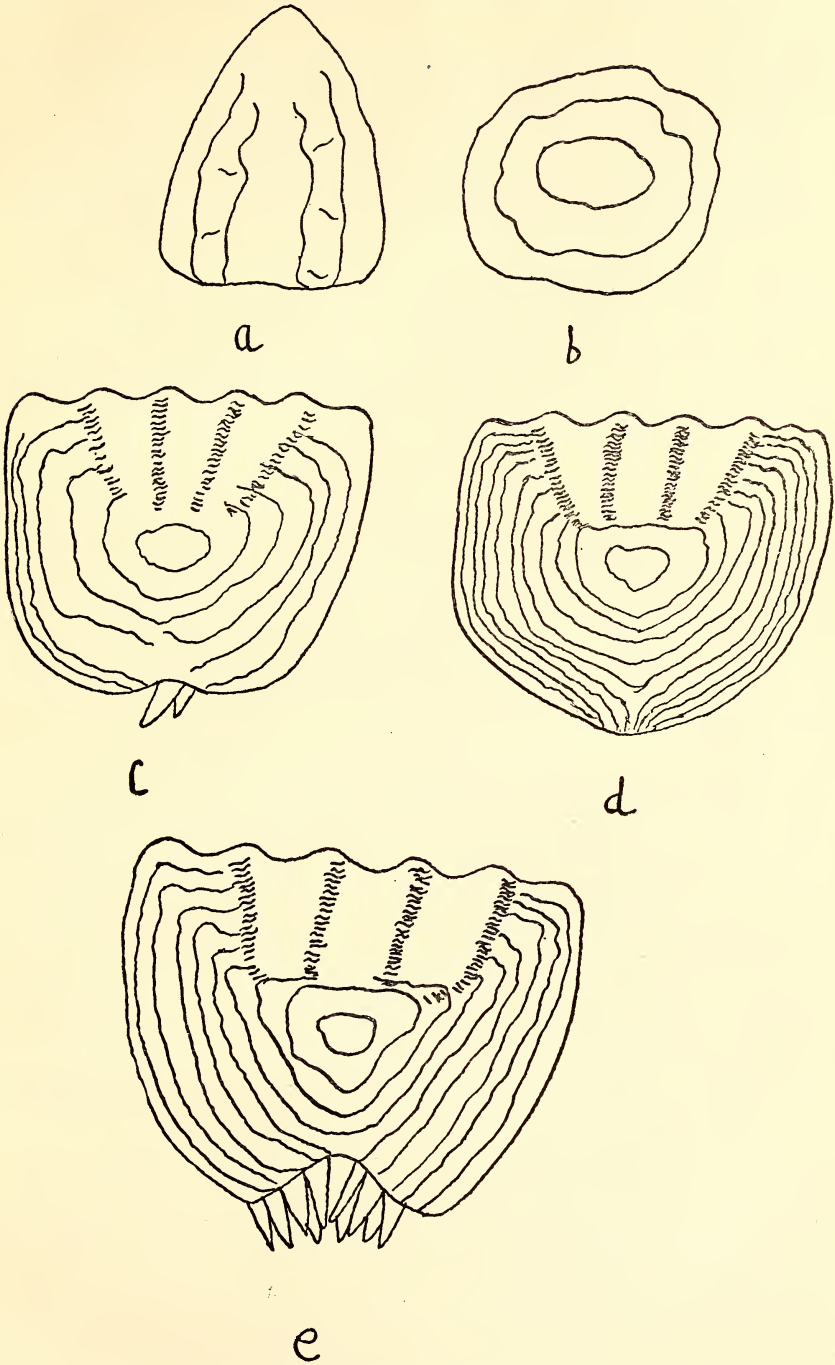


Fig. 4. Developmental stages of scales in *L. cascasia* (Hamilton).

(a) Cycloid scale from a 14.10 mm. long post-larva (b) same from the head region (c) Ctenoid scale from a 18.70 mm. long post-larva (d) Typical cycloid scale from a 30.20 mm. long specimen (e) Typical ctenoid scale from a 28.70 mm. long specimen.

stage (18.70 mm.) the scales on the body have become ctenoid, in the majority one to two ctenae having appeared apically. The cycloid scales on the head have developed additional circuli.

With further growth, the scales assume the typical ctenoid pattern. A typical scale of a 28.70 mm. long fish has 7 to 8 circuli, 3 to 4 radii and about 8-9 ctenii. Cycloid scales with 10-11 circuli and 3 to 4 radii are fairly common. A typical cycloid scale from the head region has 11 to 13 circuli.

The pattern of the development of scales in *L. cascasia* parallels that of *Mugil corsula* described by Pakrasi & Alikunhi (1952).

As the work is of a preliminary nature it has not been thought necessary to refer to all the literature on the development of scales in *L. cascasia*.

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